TEMPLATING COMMAND AND CONTROL WARFARE: SLAYING THE HYDRA OR CHASING CHIMERAS?

A MONOGRAPH
BY
Major Manuel A. Rodriguez VII
Military Intelligence

MENS EST CLAVIS VICTORIAE

**School of Advanced Military Studies
United States Army Command and General Staff
College
Fort Leavenworth, Kansas**

First Term AY 96-97

REPORT DOCUMENTATION PAGE

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE 17 December 1996	3. REPORT TYPE AND DATES COVERED MONOGRAPH

4. TITLE AND SUBTITLE

Templating Command and Control Warfare: Slaying the Hydra or Chasing Chimeras?

5. FUNDING NUMBERS

6. AUTHOR(S)

Major Manuel A. Rodriguez, U.S. Army

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

School of Advanced Military Studies
Command and General Staff College
Fort Leavenworth, Kansas 66027

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Command and General Staff College
Fort Leavenworth, Kansas 66027

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

Distribution statement A

12a. DISTRIBUTION/AVAILABILITY STATEMENT

"Approved for public release; distribution is unlimited."

12b. DISTRIBUTION CODE

"A"

13. ABSTRACT (Maximum 200 words)

SEE ATTACHED

14. SUBJECT TERMS

15. NUMBER OF PAGES
37

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNLIMITED

Abstract

ACHIEVING TACTICAL DECAPITATION: SLAYING THE HYDRA OR CHASING CHIMERAS by Major Manuel A. Rodriguez, 37 pages.

The recent notion of the increasing importance of information as a means of exercising control over ones military forces has come to the forefront of military thought dominating professional discussions and journals alike. This realization of the importance of information as the medium of control for armies on the modern age has led to the formulation of the concept of Command and Control Warfare (C2W). Command and Control Warfare represents the merging of the four previously independent elements (Operations Security, Military Deception, psychological Operations, Electronic Warfare, and physical destruction of targets) in a synergistic union to sever the enemy command from its subordinate units, in effect decapitating him. Critical to this effort is the role of intelligence and the intelligence system. Intelligence serves as the driver for C2W in that it is used to identify enemy vulnerabilities, and measure success of C2W operations.

The method used to conduct intelligence operation at the tactical level in the US Army is the Intelligence Preparation of the Battlefield process. This is a systematic and continuous process for evaluating the physical aspects of the battlefield, but lends itself, with some modification to the support of C2W. One of the key products in the IPB process is the situation template, also called a "snapshot in time" of the enemy forces. By modifying the situation template to depict C2W type targets the intelligence staff can contribute significantly to the conduct of C2W operations. With the means of control changing as a result of the availability, velocity and amount of information, the products used for decision making must evolve as well. The situation template must change into a more dynamic product than it currently is.

Only be recognizing the changes that are taking place can the military effectively move to retain the initiative that we currently enjoy. The role of information will become more critical as we move firmly into the Information Age and the manner that we use to approach operations must reflect this understanding.
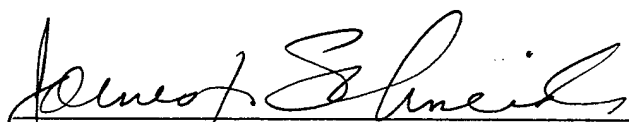
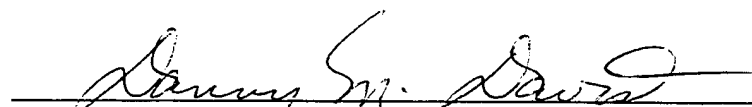## SCHOOL OF ADVANCED MILITARY STUDIES

MONOGRAPH APPROVAL

Major Manuel A. Rodriquez VII

Title of Monograph: *Templating Command and Control Warfare Slaying the Hydra or Chasing Chimeras?*

Approved by:

_____ Monograph Director
James J. Schneider, Ph.D.

_____ Director, School of
COL Danny M. Davis, MA, MMAS   Advanced Military
                                       Studies

_____ Director, Graduate
Philip J. Brookes, Ph.D.   Degree Program

Accepted this 20th Day of December 1996

Abstract

ACHIEVING TACTICAL DECAPITATION: SLAYING THE HYDRA OR
CHASING CHIMERAS by Major Manuel A. Rodriguez, 37 pages.

The recent notion of the increasing importance of
information as a means of exercising control over ones
military forces has come to the forefront of military
thought dominating professional discussions and journals
alike. This realization of the importance of information as
the medium of control for armies on the modern age has led
to the formulation of the concept of Command and Control
Warfare (C2W). Command and Control Warfare represents the
merging of the four previously independent elements
(Operations Security, Military Deception, psychological
Operations, Electronic Warfare, and physical destruction of
targets) in a synergistic union to sever the enemy command
from its subordinate units, in effect decapitating him.
Critical to this effort is the role of intelligence and the
intelligence system. Intelligence serves as the driver for
C2W in that it is used to identify enemy vulnerabilities,
and measure success of C2W operations.

The method used to conduct intelligence operation at the
tactical level in the US Army is the Intelligence
Preparation of the Battlefield process. This is a
systematic and continuous process for evaluating the
physical aspects of the battlefield, but lends itself, with
some modification to the support of C2W. One of the key
products in the IPB process is the situation template, also
called a "snapshot in time" of the enemy forces. By
modifying the situation template to depict C2W type targets
the intelligence staff can contribute significantly to the
conduct of C2W operations. With the means of control
changing as a result of the availability, velocity and
amount of information, the products used for decision making
must evolve as well. The situation template must change
into a more dynamic product than it currently is.

Only be recognizing the changes that are taking place
can the military effectively move to retain the initiative
that we currently enjoy. The role of information will
become more critical as we move firmly into the Information
Age and the manner that we use to approach operations must
reflect this understanding.

The Hydra and the Chimera

Hy·dra (hī¹dre) *noun*

1. *Greek Mythology.* The many-headed monster that was slain by Hercules.

2. persistent or multifaceted problem that cannot be eradicated

by a single effort[1]

Chi·me·ra also **Chi·mae·ra** (kĭ-mîr¹e, kî-) *noun*

1. *Greek Mythology.* A fire-breathing she-monster usually represented as

a composite of a lion, goat, and serpent.

2. lightweight, light as air, airy, ethereal nonphysical, nonmaterial,

bodiless, bloodless, incorporeal[2]

This monograph uses two mythical beasts to illustrate what has come to be known as Command and Control Warfare (C2W). These are the Hydra, a fierce snake-like with nine heads, and the Chimera, a creature made of wildly disparate parts of other animals that was ethereal. While the Hydra could be killed, the Chimera was intangible and could be seen but neither captured nor killed.

The second of Hercules's nine labors was to go to a place called Lerna and slay the Hydra that dwelled in a festering swamp terrorizing the locals. As he set out, Hercules was supremely confident that he would easily prevail, after all he was the strongest man on earth. He soon found, however, that killing the Hydra was a great deal more difficult than

1

he had expected. As soon as one of the heads was struck from the body two grew back. After much fighting with little results, Hercules hit upon the idea of searing the stump of the neck with a burning torch preventing the heads from growing back. In this manner, he eventually prevailed over the Hydra and continued with the rest of his labors

Today we are faced with a similar dilemma. We have experienced a Revolution in Military Affairs, as some have labeled it, and are entering the "Information Age."[3] Our problem? Despite the fact that we are in many ways like Hercules, the strongest man on earth, we will have to deal with enemies who have access to some of the more sophisticated equipment available in the world, such as cellular telephones, frequency hopping radios, and access to satellites for Command and Control (C2). The Hydra, referred to earlier, stands as a metaphor for the sort of adversary we will face as we enter the Information Age. The many heads of the beast illustrate the redundancy of these C2 systems. Using these systems and technologies, our potential adversaries have quite effective C2 over their units, and subordinates. These adversaries use civil communications networks to pass information and exercise C2 over their forces. These countries, or nonstate players are not necessarily hampered by our rather lengthy acquisition

process, interoperability issues, or our budgetary constraints. Like Hercules we must decide how to decapitate our modern Hydra and keep its ugly heads from regenerating themselves.

This monograph looks at the changing role of information in warfare today and the evolution of the concept of Command and Control Warfare (C2W). The increased reliance on information as a means of control has been called the cybernetic domain of battle.

The objective of C2W is to sever the command structure of an enemy army from its subordinate units. When the commander is unable to exercise control over its subordinate units they cannot act together and become easier to engage and destroy. By focusing on the means and methods the enemy uses for command and control, C2W is an effective weapon for paralyzing the enemy.

A key to success in this endeavor is a robust intelligence system that can provide the information to the friendly commander in a timely and efficient manner that enables him to act faster than his opponent. This requirement is vitally important in supporting C2W. The discussion on intelligence will center on the US Army's Intelligence Preparation of the Battlefield Process (IPB) within the context of C2W. The method for identifying and

developing targets during the IPB process will be examined and expanded upon to include the specific C2W type targets.

Once these C2W targets are identified, they must be tracked and monitored continuously to determine the effects of the friendly C2W operations. What is used to describe these targets to the commander, and what method is used to update them.

As we plan and apply C2W in support of our nation's interests we should remember the Hydra and the Chimera. In our efforts to sever our modern Hydra's many heads from its various necks, we should concentrate on ensuring that our targets are the right ones and the effects our operations produce are the ones we need. We should not chase the Chimera, it is a phantom and we will never catch it.

Information

"Information networks straddle the world. Nothing remains concealed.

But the sheer volume of information dissolves the information.

We are unable to take it all in."[4]

What is information? Quite simply, it is "data collected from the environment and processed into a usable form."[5] The importance of information today is not so much that the character of information has changed, but in the

4

amount available, and the velocity at which it now travels. These factors have led to an increasing reliance on information as a means of exercising control over one's subordinates. Information is available to decision makers at every level in enormous and unprecedented amounts. The quantity of information available to a military unit today has led to some debate on limiting the amount of information that enters a command post. The use of computers to assist in the fusion and collating of the information gathered on the battlefield already has begun and shows promise for the future.[6]

Since 1976, the term "Information Warfare" (IW) has been in use. It has, however only been since the end of the 1991 Persian Gulf War that information has been recognized as a truly critical element in war. This realization that the evolving nature of warfare relies heavily on information has lead to interest in the concept of IW. Information Warfare is defined as "actions taken to achieve information superiority by affecting adversary information, information-based processes, information systems, and computer-based networks while defending one's own information, information-based processes, information systems and computer-based networks."[7] This loose definition encompasses a wide range of activities and operations during peacetime as well as

across the spectrum of conflict. Threats to the information infrastructure come from a variety of sources with an almost limitless range of options for action.

Some have argued that IW is useful only for attacking "behind the lines"[8] and focuses on the industrial, logistic, and economic targets of the enemy, or in other words strategic targets. This sort of categorization confines one as much as the lockstep separation between the tactical and operational levels of war drawn between the division and corps levels. Information Warfare is as much a factor in the tactical level of war as the strategic or operational levels. Just as information and intelligence are critical in the three levels of conflict, so too is information warfare. Information has always been a critical part of warfare.[9] Indeed, one would be hard pressed to find a battle or campaign in which information did not play an important role in the outcome. The classic military philosophers of warfare have each stressed the import of information and intelligence. Knowledge about the terrain and enemy has always been one of the keys to victory. But why has there been a sudden interest in information as a means of success on the battlefield?

What is the importance of information to the modern decision maker? Information is required in increasing

amounts to help shorten the amount of time required to act upon it. This is called, variously, the "Boyd Cycle, "the Decision Cycle," and "the Observe-Orient-Decide-Act (OODA) loop".[10] The basis of this cycle is the idea that the commander first observes the situation. Considering this observation the commander orients his forces in an advantageous position. Once the forces are oriented properly the commander decides upon the commitment of his forces and finally he acts by dispatching forces. Boyd theorized that the commander who is able to move through the four phases of the cycle faster than his opponent gains and maintains the initiative. The enemy is forced to respond to this increased tempo of events and cannot act in a concerted manner and loses cohesion.[11]

The business of battle command has since time immemorial been "commander only," while the staff as we know it is a relatively new phenomenon. Historically a commander could survey the battlefield from a convenient hilltop and direct his troops to the decisive points on the battlefield. As the armies of the world grew, so did the need for a better method of managing information and for more effective means of control. Information flowed not only to the commander, but from the commander to his subordinates. The role of the commander underwent a metamorphosis along with the growth of

the army. He needed to control the movements of his units that were no longer in his line of sight. The evolution (and subsequent growth) of the staff as a medium through which the commander could control his forces is a manifestation of the increasing complexity of warfare. This led the armies of the world to attempt a variety of methods for assisting the commander. During the Middle Ages, the commander was be accompanied to the field by his retainers who served as bodyguards and as a personal staff to transmit orders to the army. Gradually, the use of retainers, as conduits, demanded that they become more a part of the command and control of the army.

Up to the end of the last century command and control rested in the ability of a messenger to gallop over hill and dale, hopefully to the correct unit, and deliver orders from the commander. There are many instances during which this method has lead to setbacks on the battlefield. The problems with this system become evident when examining the events leading to the famous charge of the Light Brigade during the Crimean War (1854).

From his position on the heights overlooking the battlefield of Balaclava, Lord Raglan, commander of the British forces, could see the Russian preparing to remove British Naval cannons from a redoubt that they had captured

earlier.[12] To prevent this he had one of his staff prepare

an order for the Light Brigade of cavalry:

> *"Lord Raglan wishes the cavalry to advance*
> *rapidly to the front-follow the enemy and try to*
> *prevent the enemy carrying away the guns. Troop*
> *Horse Artillery may accompany. French cavalry is*
> *on your left. Immediate.   (signed) R. Airey."*

This dispatch was hand carried by one of Raglan's aides-

de-camp, Captain Nolan to Lord Lucan, commander of the Light

Brigade, who read and misunderstood the order. From his

position some 600 feet below Raglan and his staff, Lucan

could not see the Russians, the redoubt, or the guns. When

Lucan asked for clarification, Nolan indicated the end of

the valley with a wave of his hand where several Russian

batteries had established themselves. Lucan had the Light

Brigade charge artillery positions without the support of

infantry and his unit suffered heavy losses.[13]

What were the C2 problems that resulted in the ill fated

charge of the Light Brigade? Lucan could not get

clarification from his superior because of the time involved

in the transmission of the message. Raglan, on the other

hand, could do nothing but watch the Light Brigade charge at

the wrong enemy and hope for the best.[14]

On the eve of the Battle of Waterloo, the Duke of

Wellington was offered the opportunity to fire upon Napoleon

by one of his artillerists. Wellington dismissed this

notion saying "It is not the business of commanders to fire upon one another." It is not clear when this rather courtly sentiment was dispensed with in the name of expediency is difficult to determine. What is clear, however, that as the dimensions of the battlefield expanded, a system had to be designed to provide the commander with the means of exercising control over his subordinates.

The import of the commander, or rather his command post, has clearly increased as the C2 means have improved. Napoleon, for instance had three command posts. The *Grande Quartier-Général* that functioned as a main command post for the *Grande Armée* (complete with all the retinue and straphangers one might expect in such an affair), The *Petit-Quartier-Général*, which could be termed a "Command Group" in today's parlance. The *Petit-Quartier-Général* consisted of a small group of picked staff officers, aides and an escort of cavalry. This allowed Napoleon to move rapidly about the battlefield to critical points. Often Napoleon used a specially designed carriage with small lockers, bookshelves, tables and the like, that allowed Napoleon to continue his work while he traveled. Because of its importance as a communications node, the command post rapidly changed into a prime target of any forward observer observant enough to see it.

The development and use of the telegraph did little to
ease the burden of the tactical commander. Battlefield
orders were still passed using bugle calls or a messenger.
The development of the field telephone was heralded as an
unprecedented means of control, and adopted by the great
armies of the world. The commander and his staff could now
receive all manner of reports from the units in contact in
the comfort and safety of their command post. The
advantages of the field telephone as a means of command and
control are significant. Artillery could be called for and
adjusted and attacks coordinated more easily and
effectively. Once the forward units advanced, however, the
messenger came back into the forefront of things and never
quite disappeared from the scene until the Vietnam conflict.
Nevertheless, the field telephone became an important part
of the C2 architecture of the modern army and played an
important part in the move towards an information war.

Improved communications devices, such as the radio
changed the character of warfare. Armies could employ fluid
formations and commanders could now converse with
subordinates miles apart. Information could flow in both
directions almost simultaneously, and the C2 structure
changed once again.

As information played an increasingly important role in
the conduct of modern warfare, so too has the idea that
knowledge truly is power. The concept of Information
Warfare has two sub-components: Offensive IW, and Defensive
IW. The object of offensive IW is to prevent the enemy from
utilizing his information systems and/or to feed the enemy
false information to interfere with his OODA loop.
Defensive IW, on the other hand concentrates on protecting
one's information systems from attack (hacking, chipping,
and the like). This allows friendly commanders to access
their own information systems increasing the speed at which
they can move through the OODA loop.

C2W

". . . we can confuse the enemy by attacking with varied techniques when the

chance arises. Feint a thrust or a cut, or make the enemy think you are

going to close with him, and when he is confused you can easily win."[15]

The United States military has for some time understood
the importance of decapitating the enemy. Going as far back
as the 1970's when the acronym Command and Control
Communications Countermeasures (C3CM) was developed.
Command and Control Communications Countermeasures focused
the efforts of a unit on the command structure of the enemy
while attempting to protect one's own from the same sort of

12

treatment. Following DESERT STORM, C3CM was examined to define its role in warfare. One of the changes recommended and instituted was the changing of the name from C3CM to C2W to indicate that this was a strategy as opposed to a capability or function. The real change, however was the recognition that C2W was a command responsibility rather than an the C3CM planning experts.

"Command and Control Warfare (C2W) is the warfighting application of Information Warfare in military operations."[16] It consists of five integrated elements within two disciplines. The elements of C2W are: Operational Security (OPSEC), military deception, Psychological Operations (PSYOP), Electronic Warfare (EW), and physical destruction.[17] While the some of the individual elements of C2W, such as deception, psychological operations and the physical destruction of the enemy C2 have been used in warfare since the dawn of time, others are relatively new, like electronic warfare.

The C2W disciplines are: C2-attack, and C2-protect. The object of C2 attack is to prevent the enemy from exercising C2 over his "forces by denying information to, by influencing, by degrading, or by destroying the adversary C2 system."[18] The object of C2 protect is to allow the

friendly commander to exercise C2 over his own forces, neutralizing enemy efforts to prevent this from occurring.

C2W is more than sophisticated equipment, "its object is to decapitate the adversary's decision-making apparatus from its combat forces"[19] rendering them ineffective. The success of the C2W plan relies on the integration of the five elements above to produce enhanced effects. This synergistic application of the five C2W elements magnifies their combat power and is the essence of C2W. Taken individually, each of the elements of C2W is not necessarily decisive. It is only in their combination and integration that we find the true strength of C2W.

Operations Security supports C2W by denying the enemy information about the friendly forces that are critical to his decisionmaking process. Without critical information about friendly forces the enemy is less able to act decisively against the friendly forces. In denying information to the enemy, the OPSEC program supports the other elements of C2W. By helping to conceal true dispositions and information while the enemy is allowed to see the deception story, it is apparent that OPSEC and deception are mutually supporting.[20]

Complementing the OPSEC program is military deception. Deception is an integral part of the C2W concept because it

supports the goal of decapitating the enemy C2 structure by focusing the enemy commander on something other than the real operation making the enemy more vulnerable to the effects of surprise. Deception allows friendly forces, the time and freedom of action required to conduct operations while the enemy focuses on something else.

The battle of Kurikara that took place in 1183 during the Gempei War (1180 - 1185) provides an example of the interrelationship between OPSEC and military deception.[21] Kurikara was a decisive battle between the rival clans: the Taira a noble clan from the Kyoto area of Japan, and the Minamoto clan composed of tough mountain men raised and led by a samurai named Kiso Yoshinaka. The Taira army encamped in a strong position blocking a narrow pass over the Kurikara valley. Lacking the combat power for a direct assault, Yoshinaka selected a strategy that took advantage of his enemy's weakness. Knowing that the leadership of the Taira army was fixated on the traditional virtues of the samurai and that the army was experiencing serious morale problems, Yoshinaka sent one detachment to the rear of the enemy, and three to the base of the Kurikara Valley, immediately below the pass on which the Taira army was located. In order to conceal these movements Yoshinaka arranged for a display of thirty white banners in a location

where the Taira could see them. This created the impression that the Minamoto clan had a much larger army than was actually the case. This also helped to fix the Taira's attention on the portion of the enemy they could see. Yoshinaka further distracted the Taira by having his own samurai engage them in the traditional Japanese manner: individual combat by small numbers of samurai. The Taira, having a strong sense of custom, wanted a chance to prove themselves. Thus they engaged in small level actions with a few samurai at a time while the bulk of their army remained idle. The Taira felt no threat because of their strong positions and continued to skirmish inconsequentially with Yoshinaka's men. This continued throughout the day until shortly after sunset when Yoshinaka had his men release a herd of oxen they had rounded up earlier, and sent the beasts charging along the pass with flaming torches tied around their horns. Yoshinaka's army, which up to this point had been watching patiently nearby, charged from the northern slope into the confused mass of the Taira army. There was no place for them to go, but down the steep slope into perceived safety of the Kurikara valley. The paths down the slope and into the valley soon ran out and Yoshinaka's detached units fell upon the fleeing samurai, cutting them down in droves. Yoshinaka's men vigorously

pursued the defeated enemy and the pursuit turned into a route, and a major victory for Yoshinaka.[22]

Psychological operations support C2W at each level of conflict. PSYOPS can amplify the effects of deception or a C2 attack leading the enemy to believe that friendly forces have greater capability than is actually the case, or they can support C2 protect by countering the effects of the enemy's propaganda efforts.

An excellent example of psychological operations occurred during the conquest of Mexico by the Spaniards. The Aztecs initially believed that the Spaniards were gods from Aztec mythology who had returned as predicted by the major deity in the Aztec pantheon, Quetzalcoatl. This created enough indecision in Montezuma, the Aztec king, that the Spaniards were able to establish a lodgment and create alliances among the native tribes who were disenchanted with Aztec rule and their continual demand for captives to sacrifice. As the Spaniards moved towards the Aztec capital[23] and clashed clash with the Aztecs, they found that the Aztecs had never encountered horses before and were terrified of them. Time and again a small handful of mounted Spaniards charged hundreds of Aztec warriors scattering them. While the Spaniards created neither the myth of their own divinity, or the Aztec unfamiliarity of horses, they were quick to

identify these weaknesses and ruthless in exploiting them in pursuit of their objectives. Using these weaknesses in their enemy the Conquistadors fought their way to the Aztec capital, captured Montezuma, and toppled the Aztec empire.

A more modern parallel took place during the First World War. The Imperial German Army designated certain allied units for repeated chemical attacks. As soon as that particular unit was discovered in the front lines the Germans would launch repeated chemical attacks for the duration of the unit's stay in the trenches. The purpose for these sort of tactics was to create poor morale in the enemy units being targeted. Different from the first case, the Germans, understanding the fears caused by poison gasses worked to create and reinforce these fears it their enemies. Apparently their efforts were quite effective in reducing the morale and combat effectiveness of the Allied units they targeted.

Electronic Warfare (EW) involves the struggle for control of the electromagnetic spectrum. We must remember that the electromagnetic spectrum runs the spectrum from visible light through infrared, ultraviolet, to gamma rays. Electronic Warfare also encompasses Directed Energy Weapons (DEW). Electronic Warfare and consists of three elements:

Electronic Attack (EA), Electronic Protect (EP), and Electronic Support (ES).

Electronic Attack is generally thought of as jamming, and while this is correct it can encompass other activities as well. During the Second World War the US 8th Air Force used a device called "Carpet" to jam portions of the German "Würzburg" air defense radar network.[24] "Carpet" consisted of millions of aluminum strips dropped in clouds along the bomber stream. The strips diffracted the German radar and prevented them from determining the number and location of the American bomber aircraft. Carpet was deemed useful enough to be used throughout the war, although the protection it offered was dependent on the vagaries of the wind and the ability of the drop aircraft to lay a suitable pattern at the proper altitude.

The EP function is measures taken to allow the friendly use of the electromagnetic spectrum. These measures include such relatively simple measures as the use of the Signal Operating Procedures (SOI), the Joint Restricted Frequency List (JRFL) for frequency deconfliction. These can "prevent fratricide among friendly electronic emissions."[25]

Electronic Support (ES) is meant to enhance the situational awareness of the friendly commander. During the Second World War, the British Radio Security Service (RSS)

gathered immense amounts of information regarding German military key codes. Key codes are the settings used on the German Enigma coding machine.[26] The enigma codes themselves were never cracked, an Enigma machine fell into British hands early in the war. Once the British had the machine it was a matter of finding the correct settings for the rotors Once they found the rotor settings, the British could read the message traffic sent by the various German military organizations. The RSS ended up breaking almost one hundred and twenty Enigma codes leaving less than ten unbroken at the close of the war. The interception and breaking of these key codes was a major intelligence coup for the Allies. This monumental effort provided the Allies with vital intelligence regarding almost all aspects of the German war machine and doubtless saved many lives and sped the end of the war. A sampling of some of the more significant codes intercepted and broken by the RSS is found at Figure 1.

Key Name	Branch of Service	Subject of Contents	Date Broken
PINK	Luftwaffe	Secret Info.	1/1/42
LIMPET	Kriegsmarine	U-Boats	12/10/42
TOUCAN	Wehrmacht	Logistics: Italy	11/10/43
CORNCRAKE	Wehrmacht	V-Weapons	5/12/44
GRAPEFRUIT	SS	Camps Admin.	8/21/44

Figure 1. Selected German military key codes intercepted and broken by the RSS during the Second World War[27]

20

Physical destruction is the fourth and final pillar of C2W. As part of the overall C2W plan, firepower is applied against targets identified by the intelligence system as C2W nodes. Destruction through the use of firepower can be considered something other than the *de-facto* destruction of the target. Degradation of the target may produce the effects required by the commander. Two types of destruction are recognized in the C2W arena: the "hard kill" and the "soft kill."

Hard kills are easiest to define; the target is physically disabled or destroyed. In other words, somebody attacks it. Methods for the destruction of C2W targets include maneuver forces, artillery, cruise missiles, rotary wing, and fixed wing aircraft.

Soft kill, also called "mission kill," technologies can permanently disable the C2 target without actually destroying it. Directed Energy Weapons can produce these effects in targets such as satellites. Non-lethal soft kill technologies can temporarily disrupt the target focuses more on interdicting the information flow of the target. The jamming, disruption, saturation, misrouting and delaying are some methods of executing a soft kill.[28]

Command and Control Warfare rests firmly upon a foundation of intelligence. Information that is collected

and analyzed is critical to the overall C2W effort. The effects of C2W cannot possibly be synchronized to produce the synergistic effects necessary without an intelligence system that is accurate, timely and responsive. A robust intelligence system will assist in determining the correct blending of C2W elements in the correct amounts to achieve the results required to support the overall mission.

Intelligence

"Intelligence is like eggs, the fresher the better."[29]

What, then is the driver, for C2W? Very clearly it is intelligence. In order for any of the elements of C2W to be successful an intelligence structure must be in place that will support it. Intelligence provides feedback on the success of the OPSEC program, the manner in which the deception plan is affecting the enemy, and the effectiveness of EW. Having examined the character of information previously, what is the character of information we must now look at the character of intelligence. Intelligence is defined as: "The product resulting from the collection, processing, integration, analysis, evaluation, and interpretation of available information concerning foreign countries or areas; also information and knowledge about an adversary obtained through observation, investigation,

analysis, or understanding."[30]   In a nutshell, intelligence is information that has been processed into a useful format. The intelligence structure provides rapid and accurate information to the commander on the success the PSYOPS are having and information on changes that must be instituted for better effects. Similarly, intelligence provides Battle Damage Assessment (BDA) to measure the effectiveness of the friendly efforts to destroy C2W targets.   Therefore, intelligence serves as the foundation upon which C2W rests and draws its power. Intelligence is truly the engine for C2W.

The US Army method for conducting intelligence operations is the Intelligence Preparation of the Battlefield Process (IPB). The IPB process is designed primarily for analysis of the terrain, weather, enemy and the like but lends itself to the analysis of C2W targets.   "IPB is a systematic, continuous, process for analyzing the threat and environment in a specific geographic area. It is designed to support staff estimates and military decision making. Applying the IPB process helps the commander selectively apply and maximize his combat power at critical points in time and space . . ."[31]   The Intelligence Preparation of the Battlefield is a four-step process in which the analyst defines the battlefield environment, describes the

battlefield's effects, evaluates the threat, and determines threat courses of action.

In the first step of the IPB process the S-2 defines the battlefield environment. Within the scope of C2W this encompasses the identification of such items as enemy C2 nodes, the civil communications infrastructure on the national, regional and local levels. Information regarding the enemy capability to push information and intelligence down from the national level to the tactical level. With this in mind the limits of a unit's battle space may be quite large if the enemy is a technologically advanced country. The same often holds true if the enemy has access to advanced technology. When establishing the limits of a unit's Area of Interest (AI) the S-2 must consider the character of the threat his unit faces. What is their ability to project power? What is the enemy ability to move forces into the Area of Operations (AO)? Doctrinal manuals on the subject indicate that a unit should consider several AIs, such as ground, air, and political.[32] This being the case, it stands to reason that given the increasing availability of technology around the world, and the potential for engagements in such areas, there should be an AI for C2W type targets.

This AI for C2W operations can be unmanageably large unless commander provides the S-2 certain limitations in the scope of his analysis. This guidance need not be lengthy, but must be to the point: "only look for division level command posts", or "I am interested primarily in the enemy air defense C2 architecture." Limitations imposed by terrain should be taken into consideration, however when one surveys the technology in existence today for reliable communications this factor takes a backseat.

As part of the collection effort it is necessary to consult of available databases that have been compiled. The S-2 consults his database to determine what information he has about the enemy forces his unit faces as well as querying higher headquarters databases. Incomplete databases must be updated, or created to provide the requisite information for analysis in later stages of the IPB process. One of the important products that falls under the heading of databases are doctrinal templates.[33] Doctrinal templates depict the enemy forces and High Value Targets (HVTs) [34] unconstrained by weather and terrain. These represent threat dispositions under ideal conditions. Doctrinal templates may be produced by the S-2 himself or, as was the case during the Cold War, may be provided by the various intelligence agencies.

The second step in the IPB process is for the S-2 to describe the battlefield's effects. The objective during this step is for the S-2 to identify how the environment of the battlefield affects operations of both armies. This facilitates the selection of terrain that supports the mission. This type of analysis is critical to the success of the OPSEC program. It has significant impacts on the deception plan, and helps identify likely locations for enemy C2 nodes. In terms of a C2W target the S-2 should consider the effects the terrain will have on the establishment and the maintenance of a C2 structure for the conduct of military operations. For instance, operations in rough hilly terrain may dictate the establishment of retrans sites to facilitate radio communications. Because of the line of sight requirements for these systems the places the can practically be emplaced is relatively easy to determine.

Having defined his battlefield and determined the effect of this on operations, the S-2 turns his attentions to evaluating the threat. The objective is to produce a situation template for use in targeting enemy forces, or in our case C2W targets. Key to this is the understanding of the enemy C2 architecture using the enemy doctrine, equipment and capabilities. These tools provide the structure for analyzing the threat. Using this analytical

framework the S-2 identifies enemy forces that are critical to the enemy commanders mission success. One of the items that must be identified is the enemy HVTs. What sort of things constitute HVTs for C2W? In order to exercise command over his forces the commander must, at the minimum, have a place to command from (however mobile and temporary it may be) and a means of transmitting his orders and instructions. Indicators of likely C2 locations will depend on the local electric grid (which may become a target in and of itself), TV or radio stations, microwave relays, telephone exchanges . . . and the list goes on. The point is not to enumerate each and every potential target, but to provide an insight on the variety of targets available in the spectrum of C2W.

After conducting his analysis, the S-2 can begin to determine what the enemy will do and what his Courses of Action (COAs) might be. This is not some random prediction of all the "what might happens" on the battlefield. After careful consideration of the information gathered in the previous steps of the IPB process the S-2 can generally determine the most likely enemy COA.

Currently this is expressed in a series of templates or overlays which depict the threat forces as they could deploy in the friendly unit's AI. Time permitting, the S-2

produces several. What is the significance of these products in C2W considerations? The template allows the commander to develop a visual image of the enemy. C2W targets are a critical portion of the enemy army, and function as the nerve center for it. These templates will allow the commander to narrow the focus of the intelligence system concentrating on the targets in the C2W plan.

The IPB process is a method used to conduct a systematic analysis of the factors that will affect forces on the battlefield. Although primarily focused on the physical aspects of the battlefield, IPB methodology lends itself readily to the evaluation of architecture and as a result C2W targets.

Narrowing the focus
"To know and act are one and the same"[35]

The IPB process is dynamic enough to be utilized for planning and executing C2W operations, but what can we really expect to get out of it? Just as there are several AIs in a particular operation there should also be several types of situation templates which reflect the different domains of battle and characteristics of the battlefield area. The traditional IPB products focus primarily on the physical domain of battle; terrain and weather. "What will

the enemy do on this particular piece of terrain under these weather conditions?" These are valid questions and must be addressed in order for operations to be successful.

As previously mentioned the character of warfare has changed because of the improved means of command and control. This is linked directly to the new communications systems. This cybernetic domain of battle is part of the Achilles Heel of modern armies. Can an army disintegrate completely only because the C2 structure is rendered inoperative through the use of C2W? Probably not, almost all armies are composed of formations that are durable enough to operate for a time without directions from higher headquarters. In fact some commanders prefer not to have contact with "higher" and conduct operations as they see fit. What occurs is that units can no longer function in a synchronized manner. They do remain, however, potent and lethal fighting forces, but lack the guidance and direction from above and cannot work within the overall enemy plan.

Severing the head from the body of an army requires time for the effects to take effect. One cannot expect to see an immediate loss of cohesion in the enemy as a result of C2W. The results obtained by applying the elements of C2W are often gradual and subtle.

What sort of things can be considered "C2W Targets"? This is problematic, many potential adversaries do not have C2 structures similar to the US model. These C2 systems may be based on a myriad of factors such as, family ties, religious, tribal or ethnic lines. Nevertheless, some things remain the same. The enemy commander must have a place to command from, and he must have a means to transmit orders and instructions to his subordinates. Since C2W targets are as diverse as cellular phones, standard phones, messengers, e-mail or the radio. Identification of these means is critical to the C2W effort. Detailed analysis conducted during the IPB process will aid in identifying some of these C2W targets. Once identified the decision now arises as to the method for attacking that particular target.

Equally important is the determination of the speed at which information flows from the "front" to the enemy command. Once in the enemy command post, or headquarters what is the capacity for analysis. This sort of information supports the elements of C2W and makes the formulation of and overall C2W plan more effective than simply "making it happen."

What should IPB products for C2W look like and what should they depict? All valid questions. The HVTs that FM

34-130 indicates belong on a Situation Template fall into thirteen categories. Two of these thirteen seem to fit into the C2W category: Command and Control Communications (C3) and reconnaissance, intelligence, surveillance, and target acquisition (RISTA).[36]

As indicated previously with the increasing reliance on information, generalization like this provides nothing more than a broad category in which to look and not much actual assistance in planning. The commander and his staff require more detailed information to conduct C2W against an enemy of even modest capabilities. A different set of templates is required to conduct this sort of planning, one that is updated continuously in order to support the C2W plan. The advancements made in the intelligence community in the area of modernization and the "seamless system of systems" is a move in the right direction. This system of systems can acquire and track a specific target based on electronic signature, visual (through the use of imagery collectors), or reports from observers. The various collectors that can focus on the AI of a units can provide near real time information on the enemy and his dispositions. This information in turn can be use to update the situation template as information becomes available. Once acquired, C2W targets must be tracked vigorously. Command and Control

Warfare targets in many ways are similar to the Chimera; they exist, but are not concrete and remain elusive.

Intelligence templates are useful in depicting various pieces of information about the enemy. The situation template created in step two of the IPB process is an end product of analysis of the enemy doctrine with the physical effects of the battlefield applied. This template is used to identify the likely locations for HVTs. This being the case, a situation template that is used for the exclusive purpose of depicting C2W targets is clearly a useful product in support of the commanders overall plan. Ordinarily this is a sheet of clear acetate that is hung over a map posted in the command post. Static and unchanging it cannot be easily updated, except by manual methods that can be up to an hour old, depending on the echelon involved.[37] This sort of template is not responsive enough for the conduct of military operations in the current age.

The automating of information management systems within the command post provides a great deal of help in this arena. The type of automation available today provides fused intelligence continuously and updates this automatically. The manner of depiction comes into consideration. More information can be absorbed by visual methods than the written word, thus using standard type

monitors and wide screen television sets are quite helpful.
Despite the progress made in this direction the paper map
will probably remain the tool for decision making for some
time to come. How then, should a template, or overlay
appear?

This answer lies in things that are readily apparent to
all of us. For centuries man has played wargames of one
sort or another. Today these are computerized and quite
complex. Some things remain the same. Every game from
chess to the most complex wargame made for the computer
shares some of the same properties. These are: a depiction
of the terrain, in varying forms of abstraction, the enemy
units pieces or counters; and finally the friendly units
pieces or counters. Templates for the conduct of C2W should
shares these same qualities. The amount of detail is
limited by what the commander requires facilitated his OODA
loop. Additional information such as friendly graphics,
highlighted terrain features (key terrain depiction and the
like), and templated enemy positions, can all be added to
the display in layers or removed to facilitate the decision
making process. This again is similar to the more advanced
wargames available today in which the effects can be toggled
on or off depending on player preference.

Wargames are made for popular consumption. War, however, is far from a game. It is acted out on the battlefield by soldiers executing their missions based on the training they receive in peacetime. This training is guided in no small part by the understanding the leadership has of the threats that unit will face. The complex nature of modern war demands an equally complex solution. The threats that we now face are more diverse than at any time in our history. The solution applied to slay the Hydra must not only have the wherewithal to sever the heads, but it must sear the necks.

Like the Hydra in the ancient Greek myth our modern hydra is also many headed, defying the easy solution of brute force. The heads represent the characteristics of the redundant C2 systems that we must now deal with. Simple "fixes" yield little in terms of real results. These problems are the reality of warfare at the dawn of the Information Age.

Conclusion

"Men grow tired of sleep, love, singing, and dancing

sooner than war."[38]

In this monograph we have used the Hydra as an illustration for the sort of many headed adversaries we will

face in the future. Tough, resourceful, and difficult to neutralize it will require skill, intelligence and forces to subdue them. Information has become the medium for C2 of battlefield forces. In this cybernetic domain of battle the very system of controlling ones troops becomes a target. The development of C2W as means of preventing the enemy from exercising that control through the synergistic application of the five elements of C2W.

The foundation of C2W is intelligence because C2W cannot be applied without timely, accurate, and relevant information for the decision maker to consider. The US Army intelligence process can be readily modified to encompass C2W type IPB. Intelligence is produced by the IPB methodology provides the decision maker with focused tools for his fight. With the increasing reliance on information by adversaries around the world the production of specialized IPB products for C2W becomes quite clear when seen in this light. Indeed the current doctrine would support such an endeavor. Using these tools he can reduce the time needed to move through the OODA loop and force the enemy to react to his tempo. Intelligence Preparation of the Battlefield templates are useful in this regard because they provide a visual depiction of the events on the ground.

More information is absorbed in this manner than by reading written reports.

The implications of the C2W battlefield are legion. The US intelligence system must be more robust than it is. This includes all intelligence disciplines, especially human intelligence (HUMINT), which is usually a weak link in the system. Collectors must operate around the clock and under all weather conditions. The time it takes to engage targets upon their detection must be reduced. Communications must be rapid, reliable and continuous. Perhaps the biggest change is not in the material use to conduct C2W. After all C2W is more than machines, it is a concept. The commanders and planning staffs must understand the potentials and the pitfalls of C2W. Modifying the procedures we currently use we can conduct C2W effectively and degrade or prevent the enemy from exercising C2 over his forces.

Command and Control Warfare targets represent the heads of the Hydra and must be dealt with in detail. These target characteristics are varied and their destruction or interdiction must support the overall concept of operations. Once interdicted, neutralize, or destroyed the C2W targets must be monitored closely to ensure that they do not "grow back" to cause troubles. This tends to blur the distinctions between IPB products. After all the product is

instantly incorporated into the plan and updated automatically.

The application of C2W can render an army less effective and easier to destroy, but it is not a panacea for those who would seek bloodless battles. Command and Control Warfare can make this destruction easier to accomplish because of the fragmentation of the enemy. Our task now and in the future is not only to identify and sever each of the heads of the Hydra, but to sear the necks to prevent them from coming back. In doing so our intelligence systems and the products produced from them will allow us to focus on the real targets. By modifying the application of our current doctrine we can avoid chasing the Chimera across the battlefield.

End Notes

[1] The American Heritage® Dictionary of the English Language, Third Edition copyright © 1992 by Houghton Mifflin Company. Electronic version licensed from InfoSoft International, Inc. All rights reserved.

[2] The American Heritage® Dictionary of the English Language, Third Edition copyright © 1992 by Houghton Mifflin Company. Electronic version licensed from InfoSoft International, Inc. All rights reserved.

[3] "The future time period when social, cultural, and economic patterns will reflect the decentralized, nonhierarchical flow of information; contrast this to the more centralized, hierarchical social, cultural, and economic patterns that reflect the Industrial Age's mechanization of production systems." US Army. Field Manual 100-6 Information Operations. Washington DC, 1996: Glossary-7.

[4] Günther Grass (b. 1927), German author. Interview in New Statesman & Society (London, 22 June 1990).

[5] US Army. Field Manual 100-6 Information Operations. Washington DC, 1996: Glossary-7.

[6] This has, in fact begun with the fielding of the US Army's All Source Analysis System (ASAS) which fuses information gathered about the enemy (within parameters set by the analyst) from the different intelligence disciplines, most notably Imagery Intelligence (IMINT) Electronic Intelligence (ELINT) and Signals Intelligence (SIGINT).

[7] US Army. Field Manual 100-6 Information Operations. Washington DC, 1996: Glossary-8

[8] US Army Command and General Staff College reprint. Information Warfare: 49.

[9] US Army. Field Manual 100-6 Information Operations. Washington DC, 1996: iv.
Rona, Thomas P. Information Warfare: An Age Old Concept With New Insights. Defense Intelligence Journal; 5-1 (1996): 53.

[10] Boyd, John R. An Organic Design for Command and Control.

[11] Joint Doctrine for Command and Control Warfare. Feb 1996: A1.

[12] The capture of artillery pieces was regarded as the proof of victory during this time. Raglan could not claim to have gotten the better of his enemy if he lost artillery pieces during the battle.

[13] The Light Brigade had a strength of about 700 men prior to the charge. Approximately 500 casualties were inflicted on the brigade during the twenty minutes of action. About 500 horses had also been killed.

[14] Woodham-Smith, Cecil. The Reason Why. New York: McGraw-Hill Book Company, 1953: 226 - 231.

[15] Musahi, Miyamoto 1585. A Book of Five Rings. Translated by Victor Harris. New York: The Overlook Press: 79.

[16] US Army. Field Manual 100-6 Information Operations. Washington DC, 1996: 2-4.

[17] Ibid. p.3-2.

[18] US Army. FM 100-6 Information Operations. Washington DC, 1996: 3-6.

[19] Hutcherson, N.B. Command and Control Warfare. Putting Another Tool in the War-Fighter's Data Base. Research Report. Maxwell AFB: Air University, 1994: 17.

[20] Joint Pub 3-54, Change 1, April 1994: I-2

[21] The Gempei War (1180 - 1185) was fought between the Minamoto and the Taira clans over control of Japan, which was exercised through the Emperor. The military ruler, or Shogun was the de-facto ruler of the country and did so in the Emperor's name. The Gempei war is reminiscent to the English Wars of the Roses by the use of colored banners to differentiate the combatants: red for the Taira, and white for the

Minamoto. The origins of the Gempei War are found in the 1156 coup attempt by the Minamoto clan. This was suppressed and the Tairas sought to exterminate the Minamoto clan. Only a handful of Minamotos escaped to the eastern mountains and established themselves there to return in 1180 to challenge the Taira supremacy.

[22] Turnbull, Stephen. Battles of the Samurai. New York, Arms and Armour Press, 1987: 9 - 20.

[23] This is the site of modern day Mexico City, the current capital of Mexico.

[24] Carpet, or chaff is also referred to as "Window" in some sources. Chaff is still in use today.

[25] Joint Staff. Joint Pub 3-13.1 Joint Doctrine for Command and Control Warfare. Washington DC: US Government printing Office, 1996: II-6.

[26] Early versions of the Enigma machine look like large cash registers. On the face are three rows of keys like those on a typewriter, and a set of windows, each with a letter printed on it. The machine operated when the signalman pressed one of the letter keys lighting another letter in the window. Pressing the key activated a weak electrical charge that traveled through the innards of the Enigma, around a series of three (later seven) rotors (metal wheels with letters stamped on them) before illuminating in the window. In this manner the message was transmitted. The rotors and gears in the machine scrambled the current so that no clearly discernible pattern was produced.

[27] West, Nigel. The SIGINT Secrets: The Signals Intelligence War, 1900 to Today: Including the Persecution of Gordon Welchman. New York: Quill Publishers, 1988: 303 - 307.

[28] Rona, Thomas P. Information Warfare: An Age Old Concept With New Insights. Defense Intelligence Journal; 5-1 (1996): 55.

[29] General George S. Patton.

[30] US Army. FM 100-6 Information Operations. Washington DC, 1996: Glossary 8.

[31] US Army. FM 34-130 Intelligence Preparation of the Battlefield. Washington DC, 1994: 1-1.

[32] Ibid. p. 2-6.

[33] Ibid. Glossary-6

[34] "Assets that the threat commander requires for the successful completion of a specific COA." Ibid. Glossary-7.

[35] Samurai maxim.

[36] Ibid. P. 2-33, 34.

[37] Generally each echelons command post takes between ten and fifteen minutes from the receipt of a report or message to passing it to higher headquarters.

[38] Homer. Ed. Charlton, James. The Military Quotation Book. New York: St. Martin's Press, 1990:1.

Bibliography

Books

Beriger, James R. The Control Revolution, Technological and Economic Origins of the Information Society. Cambridge: Harvard University Press, 1986.

Birdsall, Steve. Log of the Liberators, an Illustrated History of the B-24. New York: Doubleday & Company, 1973.

Carey, John, ed.1990. Eyewitness to History. New York: Avon Books.

Chandler, David G. The Military Maxims of Napoleon. Pennsylvania: Stackpole Books, 1994.

_____ Jena 1806. London. Osprey Publishing, 1993.

_____ The Campaigns of Napoleon. New York: Macmillan Publishing Co., 1966.

Charlton, James. The Military Quotation Book. New York: St. Martin's Press, 1990.

Connell, Evan S. Son of the Morningstar: Custer and the Little Bighorn. New York: North Point Press, 1984.

Crevald, Martin Van. Command in War. Cambridge: Harvard University Press, 1985.

Diaz, Bernal. The Conquest of New Spain. Translated by J.M. Cohen. New York: Penguin Books.

Fontana, David. The Secret Language of Symbols: Visual Key to Symbols and Their Meanings. San Francisco: Chronicle Books, 1994.

Hamilton, Edith. Mythology Timeless Tales of Gods and Heroes. New York: Meridian Books, 1989.

Hart, B.H. Liddel. History of the Second World War. New York: Perigee Books, 1982.

Hastings, Max., ed. 1985. Military Anecdotes. New York: Oxford University Press.

Howarth, David. Waterloo: Day of Battle. New York: Galahad Books, 1968.

Hubbuch, Susan M. Writing Research Paper Across the Curriculum. Orlando: Harcourt Brace & Co., 1996.

Hyams, Joe. Zen in the Martial Arts. Los Angeles: J.P. Tarcher Inc., 1979.

Jablonski, Edward. Flying Fortress: The Illustrated Biography of the B-17s and the Men Who Flew Them. New York: Doubleday & Company, 1965.

Keegan, John. The Face of Battle. New York: Penguin Books, 1976.

Keegan, John. The Second World War. New York: Penguin Books, 1990.

Musahi, Miyamoto 1585. A Book of Five Rings. Translated by Victor Harris. New York: The Overlook Press.

Pitt, Barrie. Battle for the Atlantic. New Jersey: Time Inc., 1977.

Prescott, William H. History of the Conquest of Mexico & History of the Conquest of Peru. New York: Modern Library.

Turnbull, Stephen. Battles of the Samurai. New York: Sterling Publishing Co. Inc., 1987.

West, Nigel. The SIGINT Secrets: The Signals Intelligence War, 1900 to Today: Including the Persecution of Gordon Welchman. New York: Quill Publishers, 1988.

Wise, Terence. The Conquistadors. London. Osprey Publishing, 1980.

Woodham-Smith, Cecil. The Reason Why. New York: McGraw-Hill Book Company, 1953.

Thesis, Monographs & Reports

Allred, K.L. *Information Warfare, A Revolution in Modern Warfighting Concepts*. Monterey: Naval Postgraduate School, 1995.

Cleckner, W.H. *Tactical Evidential Reasoning: An Application of the Dempster-Shafer Theory of Evidence*. Master's Thesis. Monterey: Naval Postgraduate School, 1985.

Dishong, D.J. *Studying the Effect of Information Warfare on Decision Making*. Monterey: Naval Postgraduate School, 1994.

Eisen, S. *Network Warfare. It's not Just For Hackers Anymore*. Final report. Newport: Naval War College, 1995.

Guthrie, S.A. *Knowledge-Based Operations: The 'So What' of Information Warfare*. Monograph. Ft. Leavenworth: Army Command and General Staff College, 1995.

Hunter, J.B. *Doctrinal Functions of Intelligence: Are They Applicable to Peacekeeping and Peace Enforcement Operations*. Ft. Leavenworth: Army Command and General College, School of Advanced Military Studies, 1993.

Hutcherson, N.B. *Command and Control Warfare. Putting Another Tool in the War-Fighter's Data Base*. Research Report. Maxwell AFB: Air University, 1994.

Lee, James G. *Counterspace Operations for Information Dominance*. Maxwell AFB: Air University, 1993.

Locke, J.S. Command and Control Warfare: Promise and Challenge for the Operational Commander. Final Report. Newport, Naval War College, 1995.

Luoma, W.M. Netwar: The Other Side of Information Warfare. Final Report. Newport: Naval War College, 1994.

Mikulin, L., and Elsaesser, D. Data Fusion and Correlation Technique Testbed (DFACTT): Analysis Tools for Emitter Fix Clustering and Doctrinal Template Matching. Technical Note. Ottawa (Ontario): Defense Research Establishment, 1994.

Nichiporuk, Brian., and Builder Carl. Information Technologies and the Future of Land Warfare. Santa Monica: Arroyo Center, RAND, 1995.

Sexton, J. Combatant Commander's Organizational View of Information Warfare/Command and Control Warfare. Final Report. Newport: Naval War College, 1995.

Tempesstilli, M. Waging Information Warfare. Making the Connection Between Information and Power in a Transformed World. Newport: Naval Post Graduate School, 1995.

Articles

"EW EXPANDS INTO INFORMATION WARFARE," Aviation Week & Space Technology, 141 no. 15, (10 October 1994): 47.

"Information Warfare Strategy Targets Most Serious Threats," Defense Week, 16 no. 50, (18 December 1995).

"Intelligence Chief Warns of *Information* *Warfare* Threats," Defense Week, (11 December 1995).

"IW poses infinite questions , few answers," Aerospace Daily, 174 no. 59, (23 June 1995): 472.

"OPERATIONS & TRAINING – DECLARING INFORMATION WAR – Early Training Crucial to Awareness," International Defense Review, 29 no. 07, (01 July 1996): 54.

"Services Gear up for Information War," Defense Daily, 184 no. 48, (8 September 1994).

"Shielding the Net against Cyber-Scoundrels." Business Week, Baig, Ed C. and John Cary. 14 November 1994.

Blair, Dennis (Rear Admiral), interview by Barbera Starr, Jane's Defense Weekly, 24 no. 17, (October 1995): 32.

Smith, Edward A. "Putting it Through the Right Window," U.S. Naval Institute Proceedings 121 no 6, (June 1995): 38.

Struble, Dan. "What is Command and Control Warfare?," Naval War College Review, 48 no. 3, (Summer 1995) 89.

Military Publications

ASD (C3I) Memorandum, Information Management Definitions, 25 Feb 1994.

CJCSI 3210.01 Joint Information Warfare Policy. 2 January 1996.

CJCSI 3210.03. Joint Command and Control Warfare Policy (U). 31 March 1996.

DOD Directive S-3600.1 Information Warfare.

US Army. TRADOC Pamphlet 52-69 Concept for Information Operations. 1 August 1995.

_____. TRADOC Pamphlet 525-5, Force XXI Operations, A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-first Century. Washington DC, 1994.

_____. FM 100-5, Operations. Washington DC, June 1993.

_____. FM 100-6, Information Operations. Washington DC, August 1996.

_____. FM 34-130, Intelligence Preparation of the Battlefield. Washington DC, July 1994.

_____. FM 34-8, Combat Commander's Handbook on Tactical Intelligence. Washington DC, September 1992.

URLs

Information Warfare Overview

http://www.nd.edu:80/~mchapple/iw/overview.html

Virtual World of Spies and Intelligence,

http://www.dreamscape.com/frankvad/covert.html

Virtual World of Spies and Intelligence [Intelligence],

http://www.dreamscape.com/frankvad/intelligence.html

Virtual World of Spies and Intelligence [Information

Warfare], http://www.dreamscape.com/frankvad/warfare.html